

Case Report

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COVID-19 Associated Unilateral Diaphragm Paralysis: A Case Report

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Diaphragm paralysis may be either idiopathic or associated with several medical conditions including viral and bacterial infection. The association of phrenic nerve palsy with viral infections is rare but well-appreciated in several case reports. Neuropathy, both central and peripheral, is a common neurological consequence of COVID-19. Here, we describe a case of diaphragm paralysis in a woman who was admitted to the hospital because of COVID-19 pneumonia. Post-COVID-19 unilateral paralyzed diaphragm was diagnosed with a chest X-ray for her and the disorder was attributed to COVID-19 because no other etiology was found to be associated. So far, phrenic neuropathy and diaphragmatic paralysis in a COVID-19-affected patient have not been reported from Iran.

Keywords: Phrenic nerve; Diaphragmatic paralysis; Peripheral neuropathy; COVID-19

INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is responsible for the global spread of coronavirus disease (COVID-19) (1-3). Although respiratory and cardiovascular systems are preferentially affected by COVID-19, there is increasing evidence suggesting the neuro-invasive potential of COVID-19 and several neurological syndromes, such as headache, dizziness, hypogeusia, and neuralgia, related to this infection have been reported (4). Any disorder interfering with diaphragmatic innervation, contractile muscle function, or mechanical coupling to the chest wall can lead to diaphragm dysfunction (5).

Herein, we describe a case of moderate COVID-19 pneumonia that developed a paralytic diaphragm during

her disease course. To the best of our knowledge, this is the first case of diaphragm paralysis secondary to COVID-19 observed in Iran so far.

CASE SUMMARIES

A 69-year-old known diabetic female manifesting shortness of breath and loss of oxygen saturation presented to the emergency ward during the peak of the COVID-19 pandemic in Iran in September 2020. Neither history of smoking nor pulmonary or thoracic diseases was reported. Nonetheless, the patient had undergone a total laparoscopic hysterectomy about 6 years ago and fibromyoma had been pathologically diagnosed. A benign breast mass was another history of her disease. She had symptoms such as dry cough, fever, myalgia, and

remarkable hypoxia with a Spo₂ of 86% (ambient air). Her vital signs at presentation revealed a temporal temperature: 38.1°C; blood pressure: 130/80 mmHg; heart rate: 92bpm and respiratory rate: 28 breaths per minute. Therefore, 5 L/min oxygen supplementation was immediately applied by nasal cannula and her SpO₂ increased to 90%-95%. Laboratory analyses including blood chemistry, complete blood count, ESR, CRP, and D-dimer were evaluated on arrival. The patient was found to have a WBC: 7×10^9 /L with 57 % neutrophils and 36% lymphocytes; CRP, ESR, and D-dimer were all noted to be sharply above the normal range. Serum chemistry was significant for blood glucose 210 mg/dL. Creatinine and BUN were both within the normal ranges. An RT-PCR tested positive for the SARS-CoV-2 virus. Multiple patchy infiltrations in all lobes of both lungs predominantly in a peripheral distribution highly consistent with COVID-19 infection (Figure 1) were revealed in the computed tomography (CT) scan of the chest (6). The color doppler echocardiography reported 60% of ejection fraction and no valve problems were seen. Abnormal neurological findings were not found during hospitalization; the brain CT scan done upon her arrival did not show any abnormality. However, the patient was admitted to the intensive care unit. Azithromycin, low-weight-molecular heparin with enoxaparin, systemic steroid therapy with dexamethasone, and antiviral therapy with remdesivir were administered as rudimentary treatment and continued for 8 days during hospitalization. Given no need for central venous catheter insertion, no device was implanted for the patient through the right subclavian or jugular veins. Improvement in the patient's clinical condition was noticed day to day. By the way, she decided to be discharged on oral naproxen and vitamin C on the ninth day.

Approximately 20 days after the discharge, the patient was referred again to the emergency department complaining of dyspnea, particularly when leaning forward. Her vital signs were normal except for the oxygen saturation, which dropped to 90% with environmental air. Chest CT demonstrated the elevation of the right side of the diaphragm (Figure 2) which was so drastic. Immobility

of the right side of the diaphragm was evidenced in sonography, which was suggestive of hemidiaphragm paralysis.

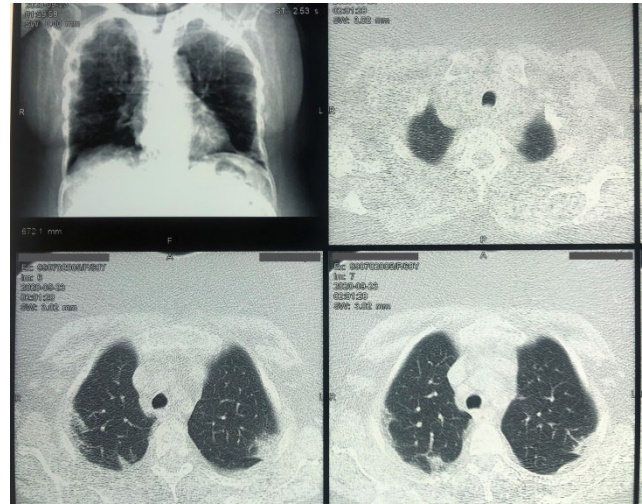


Figure 1. The CT scan of the chest with multiple patchy infiltrations in all lobes of both lungs predominantly in a peripheral distribution highly consistent with COVID-19 infection

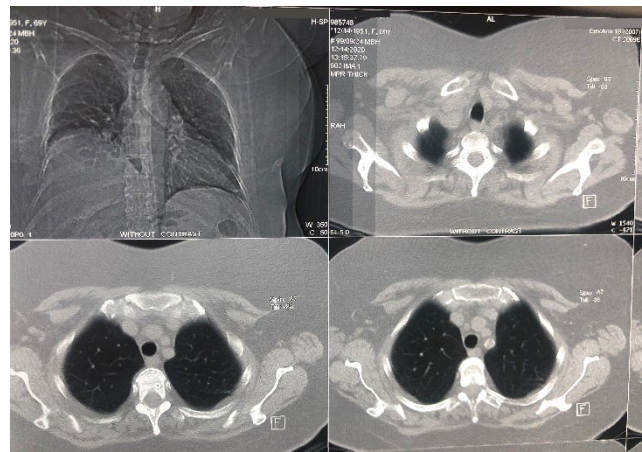


Figure 2. The elevation of the right side of the diaphragm. Immobility of the right side of the diaphragm at sonography was suggestive of hemidiaphragm paralysis

Arterial Blood gas analysis showed a pH of 7.41, PCO₂ of 49.2 mmHg, PO₂ of 69 mmHg, HCO₃ of 27.6 mmol/L. In comparison with primary admission, laboratory analysis of blood specimen was normal except liver function test including elevated levels of SGOT and SGPT (72 and 94U/L, respectively) however, bilirubin (both direct and total) was normal. Also, an increased level of anti-SARS-CoV-2-IgG was documented (14.42 U/L). Serum troponin T was negative.

Clinical evaluation illustrated a decreased right-sided breathing sound and restrictive spirometry which was associated with the reduction of diaphragm movement. Polysomnography (PSG) revealed a dramatic decline in oxygen level. Continuous positive airway pressure therapy was used for her due to the potential consequence of PSG.

Although because of the patient's refusal, no diagnosis of phrenic nerve palsy was performed, the patient was discharged and followed up at the outpatient clinic. After 3 months of follow-up, dyspnea and radiological findings, including repeated chest X-rays and computed tomography, revealed no alleviation.

DISCUSSION

To our best knowledge, in this case report, the first case of right unilateral diaphragm paralysis following mild COVID-19 pneumonia was recorded in Iran. The present patient denied any history of trauma or malignancy, and her former chest x-ray was unremarkable. Several case reports have previously described neuropathy and phrenic nerve involvement after viral and bacterial infections (6).

As observed in our patient, dyspnea caused by diaphragm paralysis limits the daily activities of the patient and makes her feel sleep disturbance. The disorder is majorly diagnosed incidentally by chest X-ray (6). Taking COVID-19-associated diaphragm paralysis into account for differential diagnosis and its timely recognition is crucial to prevent subsequent lung function insufficiency in general practice.

Diaphragm paralysis post infections caused by Herpes-zoster virus, Dengue virus, human immunodeficiency virus (HIV), West Nile virus, poliovirus, Zika virus, and *Treponema pallidum* have been well appreciated which primarily were due to phrenic nerve palsy (7). However, considering the invasive procedures, diagnosis of phrenic nerve palsy with needle electromyography of the diaphragm was not performed in the present report. Due to the paucity of literature, the possible pathological mechanisms by which phrenic nerve palsy is stimulated

after COVID-19 are obscure but an immune-mediated mechanism is postulated to be the possible etiology.

In consistent with our report, the motility of the diaphragm showed no recovery after respective antiviral and antibacterial treatments in patients suffering from syphilis and Herpes-zoster virus-associated hemidiaphragm paralysis (6, 8, 9). However, the movement of the diaphragm improved in a patient who was suffering from post-HIV unilateral phrenic neuropathy after the administration of intravenous IgG (10).

CONCLUSION

The current report highlights an unusual case of COVID-19-associated unilateral diaphragm paralysis that is probably due to phrenic neuropathy. Since the majority of cases with paralytic diaphragm may clinically remain unrecognized, therefore it is of great importance for the physician to be aware of the possibility of diaphragmatic paralysis when examining patients with COVID-19, particularly those with older age and respiratory sequela, which may deteriorate the clinical situation of the patients and cause severe respiratory failure requiring mechanical ventilation.

REFERENCES

1. Fakharian A, Barati S, Mirenayat M, Rezaei M, Haseli S, Torkaman P, et al. Evaluation of adalimumab effects in managing severe cases of COVID-19: A randomized controlled trial. *Int Immunopharmacol* 2021;99:107961.
2. Rokni M, Ahmadikia K, Asghari S, Mashaei S, Hassanali F. Comparison of clinical, para-clinical and laboratory findings in survived and deceased patients with COVID-19: diagnostic role of inflammatory indications in determining the severity of illness. *BMC Infect Dis* 2020;20(1):869.
3. Sharifzadeh K, Farzanegan B, Mirtajani SB, Peyravian F, Jahangirifard A. The Potential Role of Bromelain in the Treatment of SARS-COV-2. *J Cell Mol Anesth* 2018;5:284-5.

4. Lima MA, Silva MTT, Soares CN, Coutinho R, Oliveira HS, Afonso L, et al. Peripheral facial nerve palsy associated with COVID-19. *J Neurovirol* 2020;26(6):941-4.
5. Ricoy J, Rodríguez-Núñez N, Álvarez-Dobaño JM, Toubes ME, Riveiro V, Valdés L. Diaphragmatic dysfunction. *Pulmonology* 2019;25(4):223-35.
6. Oike M, Naito T, Tsukada M, Kikuchi Y, Sakamoto N, Otsuki Y, et al. A case of diaphragmatic paralysis complicated by herpes-zoster virus infection. *Intern Med* 2012;51(10):1259-63.
7. Ansari MK, Jha S, Nath A. Unilateral diaphragmatic paralysis following dengue infection. *Neurol India* 2010;58(4):596-8.
8. Ratnayake EC, Shivanthan C, Wijesiriwardena BC. Diaphragmatic paralysis: a rare consequence of dengue fever. *BMC Infect Dis* 2012;12:46.
9. Huh S, Chung JH, Kwon HJ, Ko HY. Unilateral Diaphragm Paralysis Associated With Neurosyphilis: A Case Report. *Ann Rehabil Med* 2020;44(4):338-341.
10. Piliero PJ, Estanislao L, Simpson D. Diaphragmatic paralysis due to isolated phrenic neuropathy in an HIV-infected man. *Neurology* 2004;62(1):154-5.